where $n_t$ is the density of filled traps per cubic centimeter at time $t$. $n_0$ is the total number of traps per cubic centimeter and $m$ is the time constant. The equation (1) can be put up in the form

$$\ln [1-(n_t/n_0)] = -t/m. \quad \ldots (2)$$

Thus a plot of $\ln [1-(n_t/n_0)]$ versus $t$ is a straight line having slope equal to $1/m$. A plot of $\ln [1-(n_t/n_0)]$ versus $t$ for a sample containing 0.025 wt. % Pd is shown in figure 2 and is obtained by assuming that the peak intensity $I_t$ after irradiation for time $t$ is proportional to the filled traps and $n_0$ is given by the plateau level $I_s$ of the buildup curve (Pawar & Narlikar 1974). From figure 2 it may be seen that the plot is nearly a straight line. The graphs obtained for other samples are also found to be almost linear. Thus these results indicate that the traps in the present system of phosphors exist prior to irradiation and are lattice vacancies. The values of $m$ calculated from the slopes of the straight lines are practically same for all samples. This suggests that the types of defects acting as electron traps are of the same nature. These defects, as earlier investigation had shown, are likely to be the sulphur vacancies (Lawangar & Narlikar 1975b).

### Reference

Bhawalkar D. R. & Malhotra B. R. 1969 *Indian J. Pure Appl. Phys.* **7**, 163
Lawangar R. D. & Narlikar A. V. 1975a *J. Luminescence* **11**, 135.
Lawanger R. D. & Narlikar A. V. 1975b *J. Mater. Sci.* **10**, 1251.
Mitchell P. V., Wiegand D. A. & Smoluchowski D. R. 1961 *Phys. Rev.* **121**, 484.
Pawar S. H. & Narlikar A. V. 1974 *J. Luminescence* **9**, 52

*Indian J. Phys.* **51A**, 221-223 (1977)

## Charge-symmetric potentials and the hypertriton

H Roy Choudhury and V. P. Gautam

*Department of Theoretical Physics*

*Indian Association for the Cultivation of Science, Calcutta-700032*

(*Received* 22 *February* 1977, *revised* 30 *March* 1977)

A choice of suitable potentials has been made for the $\Lambda N$ charge-symmetric parameters of Herndon and Tang to yield a reasonable value for $\Lambda$-separation energy in ${}_{\Lambda}{}^{3}\mathrm{H}$.

Recently two papers (Schick 1975, Gibson & Lehman 1975) have appeared regarding the $\Lambda$-binding ($B_\Lambda$) in ${}_{\Lambda}{}^{3}H$, obtained from two sets of $\Lambda$-nucleon potentials (model A and model B) derived from the low-energy-parameters of Nagels, *et al* (1972). According to the analysis of Schick (1975) both, model A and model

B meson theoretic $\Lambda N$ potentials are found to be admissible, while Gibson & Lehman (1975) by using different form of the $\Lambda N$ repulsive potentials have shown that model B gives better $B_\Lambda$ value as compared to the prediction of model A. We find that on the basis of the arguments given in Schick (1975) and Gibson and Lehman (1975) it is not possible in general to conclude exactly which of the two potential models is better. To support this remark of ours we have observed that the $\Lambda N$ charge-symmetric *(CS) parameters ($a_s = -2.76$fm, $r_s = 3.05$ fm, $a_t = -1.96$ fm, and $r_t = 3.50$ fm) of Herndon & Tang (1967) pose very interesting problem. Though these parameters lie within the limits of model B parameters, its prediction for $B_\Lambda$ value (0.625 MeV) (Roy-Choudhury & Gautam 1973) is close to that of model A. Thus there is an overlapping in the predictions of model A and model B in regard to $B_\Lambda$ value and it can be said that the $\Lambda$-binding-energy is not the decisive factor to rule out one model over the other. This value of $B_\Lambda$ (0.625 MeV) cannot be brought near the experimental finding (0.15 MeV) (Juric *et al* 1973) by the technique of Gibson and Lehman (1974). They have tried to justify their form of the $\Lambda N$ repulsive potential by making a comparison of the works of Dabrowski & Dworzecka (1968) and Gibson & Stephenson (1975) for ${}_\Lambda{}^3H$ which is governed by $NN$ forces only. $\Lambda N$ and $NN$ forces differ in the sense that there is more repulsion in $\Lambda N$ case as compared to the $NN$ one, which is evident from the two-body bound state formation for $NN$ and not for $\Lambda N$. This may lead to the argument that ${}_\Lambda{}^3H$ binding will be more sensitive to $\Lambda N$ repulsion than the ${}_\Lambda{}^3H$ binding to $NN$ repulsion.

We find that the Herndon and Tang $\Lambda N$(CS) parameters are not a bad choice except that they, like model A parameters, provide over binding (Roy-Choudhury & Gautam 1973, Gibson & Lehman 1974) for ${}_\Lambda{}^3H$ system when only the attractive potentials are used. This difficulty can easily be overcome by choosing the better form of the potential. So, we have tried to modify the form of the twobody potential such that the $B_\Lambda$ value approaches the experimental result (Juric *et al* 1973). We have used the Mongan type of rank-2 potential (Schick 1975, Schick & Hetherington 1967) for this set of parameters and obtain $B_\Lambda = 0.31$ MeV (table 1), with the soft core repulsion. This value can further be lowered down to match the experimental value by explicitly taking into account the $\Lambda\Sigma$ coupling effect. Schick and Toepfer (1968) have studied the effect of $\Lambda\Sigma$ coupling in a full two-channel representation of the $\Lambda N$ interaction. They have found that independent of the model or the $\Lambda N$ input parameters, the effect of $\Lambda\Sigma$ conversion on the system is to reduce the $\Lambda$ separation energy in ${}_\Lambda{}^3H$.

Thus our analysis supports the use of Mongan type of $\Lambda\bar{N}$ potential for ${}_\Lambda{}^3H$ binding in relation to Herndon and Tang parameters supporting the approach of Schick (1975).

*Using $\Lambda N$(CS) parameters in our three-body calculations does not mean that the charge-symmetry-breaking effects between $\Lambda p$ and $\Lambda n$ have been neglected. This point has been discussed at length in Ref. Roy-Choudhury and Gautam (1973).

Table 1. Potential parameters and $B_\Lambda$ values for $\Lambda N$ charge-symmetric low-energy parameters of Herndon and Tang (1967). The $NN$ $^3S_1$ potential parameters used here are $\lambda_1^{-1} = -2883.20(10^{-3}\,\text{fm})^2$, $\beta_1 = 2.1739\,\text{fm}^{-1}$, $\lambda_2^{-1} = 62.49(10^{-3}\,\text{fm})^2$ and $\beta_2 = 5\,\text{fm}^{-1}$

| $\Lambda N$ spin states | $\lambda_1^{-1}(10^{-3}\text{fm})^2$ | $\beta_1(fm^{-1})$ | $\lambda_2^{-1}(10^{-3}fm)^2$ | $\beta_2(fm^{-1})$ | $B_\Lambda$(MeV) |
|---|---|---|---|---|---|
| 0 | −132.30 | 1.3385 | 0 | .. | 0.625[a] |
| 1 | − 165.30 | 1.3043 | 0 | ... | |
| 0 | −8924.40 | 2.0000 | 195.47 | 5.0000 | 0.31 |
| 1 | −9125.50 | 2.0000 | 160.27 | 5.0000 | |

*a* See- Roy Choudhury & Gautam (1973).

We are thankful to Prof. L. H. Schick for a helpful communication.

## References

Dabrowski J. & Dworzecka M. 1968 *Phys. Lett.* **28B**, 4.
Gibson B. F. & Lehman D. R. 1974 *Phys. Rev.* **C10**, 888.
Gibson B. F. & Lehman D. R. 1975 *Phys. Rev* **C11**, 2092.
Gibson B. F. & Stephenson G. J. 1975 *Phys. Rev* **C11**, 1448.
Herndon R. C & Tang Y. C. 1967 *Phys. Rev.* **159**, 853.
Juric M. *et al* 1973 *Nucl. Phys.* **B52**, 1.
Nagels M. M. Rijken T. A. & de Swart J. J. 1972 in *Few Particle Problems in the Nuclear Interaction*, edited by I. Slaus, S. A. Moszkowski, R. P. Haddock and W. T. H. van Oers (North-Holland, Amsterdam) p. 42
Roy-Choudhury H. & Gautam V. P 1973 *Phys. Rev.* **C7**, 74.
Schick L. H. & Hetherington J. H. 1967 *Phys. Rev.* **156**, 1602.
Schick L. H. & Toepfer A. J. 1968 *Phys. Rev.* **170**, 946.
Schick L. H. 1975, *Phys. Rev.* **C16**, 2089.

*Indian J. Phys.* **51A**, 223–224 (1977)

# The crystal structure of succinato tetraaquo manganese II $Mn(C_4H_4O_4)$, $4H_2O$

M. P. Gupta and Raja Ram

*Department of Physics, Ranchi University, Ranchi*-834008

(*Received* 12 *April* 1977)

The structure of the title compound was investigated to determine the scheme of hydrogen bonds and oxygen ligands around manganese.